

NOTES ON SOME MALLOPHAGA FROM MAMMALS

By G. H. E. HOPKINS

THE first part of this paper is based on a large and important collection of Canadian material submitted to me for examination by Professor G. J. Spencer of the University of British Columbia; this collection contains three new species and adds details to our knowledge of a number of others. Mr. G. P. Holland, in charge of Insect Systematics and Biological Control, Canadian Department of Agriculture, added a few specimens of a species, from the American Bison, which has been recorded previously on only one occasion (from the European Bison) and about the specific distinctness of which doubts had been expressed which are completely dispelled by the presence in the present material of the hitherto unknown male. In the second part of the paper I have taken the opportunity to deal with two species (one of them new) sent to me by Col. K. C. Emerson of the United States Army and one received from Dr. F. Zumpt of the South African Institute for Medical Research. I am grateful to the senders for presenting the types of the new forms (except *Trichodectes emersoni*) and a share of the other material to the British Museum (Natural History) and to the Trustees of the Museum for all the drawings and photographs illustrating this paper.

In the counts of specimens given below nymphs are nearly always ignored, because without special collecting-methods the proportion of nymphs in a collection bears little relation to the proportion in the natural population from which the collection was made. All scientific names of North American hosts are given in the form used by Miller and Kellogg (1955, *List of N. American recent mammals*).

CANADIAN MATERIAL

Trichodectes (Trichodectes) canis (De Geer, 1778)

Ritinus canis, De Geer, 1778, *Mém. Hist. Ins.*, 7: 81, pl. 4, fig. 16.

From puppy, Kamloops, B.C., 7.vii.1935, G. J. Spencer: 1 ♂, 2 ♀.

From puppy, Vancouver, B.C., -.xi.1945, G. J. Spencer: 2♂, 2♀.

From *Canis lupus columbianus* Goldman (British Columbia Wolf), Deadman's Creek, Kamloops district, B.C., 22.i.1944, Spencer-Keyes: 7 ♂, 24 ♀.

From *Canis latrans incolatus* Hall (Northwestern Coyote), Quick, B.C., -.iii.1938, 12.xi.1940 and 14.i.1945, H. Wearne: 70 ♂, 59 ♀.

From *Canis latrans incolatus*, Birch Island, near Vavenby, B.C., 16.x.1941, T. K. Moilliet: 14 ♂, 20 ♀.

From *Canis latrans incolatus*, Springhouse, Williams Lake, B.C., April-May 1950, G. J. Spencer: many thousands of specimens. Professor Spencer notes that these were from four coyotes, but mostly from two individuals.

From *Canis latrans lestes* Merriam (Mountain Coyote), Mission, B.C., 4.ix.1940, I. McT. Cowan: 5 ♂, 11 ♀.

The type host of this species is *Canis familiaris* Linn., and it occurs on this host in nearly all parts of the world, though it is apparently absent from some of the hotter areas, where it is replaced by an unrelated species, *Heterodoxus spiniger* (Enderlein). It has also been recorded from other Canidae and there are several previous records from various subspecies of *Canis lupus* and *C. latrans*.

The sexes are usually found in rough equality (excluding the enormous batch, the total from coyotes in the present collection is 89 ♂ 90 ♀), so it is possible that the marked discrepancy in numbers between males and females in the sample from a wolf indicates some physiological differences, but it is more probably due merely to chance.

***Trichodectes (Trichodectes) pinguis euarctidos* Hopkins, 1954**

Trichodectes pinguis euarctidos. Hopkins, 1954, *Entomologist* 87 : 142, figs. 2, 3, 5, 6, 8-11.

From *Euarctos americanus cinnamomus* (Audubon & Bachman) (Rocky Mountain Black Bear), Gray Creek, Kootenays, B.C., 3.vi.1936, T. K. Moilliet : 16 ♂, 14 ♀.

From *Euarctos americanus cinnamomus*, Vavenby, B.C. 4.vi.1937, McM.: 1 ♀.

The batch from Gray Creek recorded above is from the same individual bear as the type series, and Professor Spencer informs me that there are at the University of British Columbia a further 15 males and 101 females (in alcohol) from this individual. This makes it necessary to modify my statement (1954, p. 145) that the sexes are in almost numerical equality in this subspecies, for the additional material combined with the original batch gives a total of 116 males and 206 females. Even assuming, as is very probable, that some of the specimens in alcohol which have been recorded as females are actually large nymphs, it would appear that females are considerably commoner than males.

The American Black Bear is the only known host of this subspecies, which is known from British Columbia, Ontario and Idaho.

***Trichodectes (Trichodectes) octomaculatus* Paine, 1912**

Trichodectes octomaculatus. Paine, 1912, *Ent. News* 23 : 438, pl. 20, fig. 1.

From *Procyon lotor vancouverensis* Nelson & Goldman (Vancouver Island Raccoon), Courtenay, Vancouver Island, British Columbia, 24.i.1948, G. J. Spencer : 1 ♂.

The type host of this species is *Procyon lotor psora* Gray, and it has been recorded from a number of subspecies of *P. lotor*. Records from the Crab-eating Raccoon, *Procyon cancrivorus* (G. Cuvier), however, refer to a different though closely related species, *T. fallax* Werneck.

***Trichodectes (Stachiella) ermineae* (Hopkins, 1941)**

Stachiella ermineae. Hopkins, 1941, *Ann. Mag. nat. Hist.* (11) 7 : 38.

From *Mustela erminea richardsoni* (Bonaparte) (Hudsonian Ermine), Meldrum Creek, Chilcotin, B.C., 19.v.1950, W. Cottle : 8 ♂, 12 ♀.

From *Mustela erminea anguinae* Hall, (Vancouver Island Ermine), Croteau Lake, Forbidden Plateau, Vancouver Is., B.C., 30.viii.1943, G. C. Carl : 1 ♂, 8 ♀.

From *Mustela vison energumenos* (Bangs) (British Columbia Mink), Port Moody, British Columbia, 4.ii.1951, G. J. Spencer : 9 ♂, 6 ♀.

This species was described from material collected from the British and German subspecies of the Stoat or Ermine, *Mustela erminea stabilis* Barrett-Hamilton and *M. erminea aestiva* Kerr. It does not seem to have been recorded hitherto from North American subspecies of this host under its correct name, but *Trichodectes* "retusus Nitzsch" of Osborn 1896 (*Bull. U.S. Dep. Agric.* (n.s.) no. 5, p. 237) and of Morse 1903 (*Amer. Nat.* 37:623, figs.) is probably this species. Osborn's specimens, figured by Morse, were from Ames, Iowa, and the host must have been *M. erminea bangsi* Hall. Osborn also recorded "retusus" from Mink (*Mustela vison* Schreber), and Werneck (1948, *Os Malófagos de Mamíferos*, part 1, p. 158) determined as *ermineae* specimens obtained from this latter host at Seattle (Washington) and Kirkfield (Ontario).

***Trichodectes (Stachiella) kingi* McGregor, 1917**

Trichodectes kingi. McGregor, 1917, *Ann. ent. Soc. Amer.* 10: 167, pl. 17, fig. 1.

From *Mustela rixosa rixosa* (Bangs) (Least Weasel), Ootsa Lake, British Columbia, 1.ii.1940: 3 ♂, 5 ♀.

The original record of this species was from "weasel, *Putorius* sp. from Florence, Montana; a weasel from this locality could be *Mustela rixosa*, *M. erminea* or *M. frenata*. Werneck (1948, *Os Malófagos de Mamíferos*, part 1, p. 160, figs. 239-243) redescribed the species, after examining the syntypes, and recorded it from various undetermined weasels, from *Mustela erminea* ssp., and from "Alaska Weasel", which is *M. rixosa eskimo* (Stone). I accept Werneck's determination of the specimens stated to be from *M. erminea* without hesitation, but have some reservations about the determination of the host, especially now that *Trichodectes (Stachiella) ermineae* (Hopkins) is known to occur on Nearctic forms of *M. erminea* as well as on Palaeartic ones. The main differences between these two species of *Trichodectes* is that the head is as long as broad in *kingi* but broader than long in *ermineae*. It is unfortunate that the present specimens of *kingi* are not in good condition, for the few previously known males of the species are, like these, not well enough preserved to allow a description of the genitalia to be made.

***Trichodectes (Neotrichodectes) minutus* Paine, 1912**

Trichodectes minutus. Paine, 1912, *Ent. News* 23: 439, pl. 20, fig. 4.

From *Mustela frenata oribusus* (Bangs) (Bangs' Long-tailed Weasel), Dry Farm, Nicola Range, B.C., 28.viii.1932, G. J. Spencer: 6 ♂, 4 ♀.

The original record of this species was from *Mustela frenata noveboracensis* (Emmons) (New York Long-tailed Weasel). Werneck (1948, *Os Malófagos de Mamíferos*, part 1, pp. 145, 146) saw 4 lots from *M. frenata* spp., 1 from *M. nigripes* (Audubon & Bachman) (Black-footed Weasel) and 1 from *M. stolzmanni* Taczanowski (Peruvian Weasel).

The host-distribution of the Trichodectidae found on Mustelidae in North America is peculiar and very interesting, but our knowledge of it is much limited by paucity of records, misdetermination of the parasites (and perhaps also of the hosts in some

instances) and the fact that so many of the records are from such insufficiently-determined hosts as "weasel", "*Putorius*" or "*Mustela*". It is because all the hosts have definite determinations that the few batches in the present collection make a significant contribution towards our knowledge of this subject. Ignoring records from hosts other than Mustelidae, *Trichodectes s. str.* is found in North America on the badger, subgenus *Stachiella* (barely separable from *Trichodectes s. str.*) on *Mustela*, and subgenus *Neotrichodectes* on skunks and *Mustela*. Hitherto we have had practically no indication whether both *Stachiella* and *Neotrichodectes* are to be found on the same species of *Mustela*, but the present records, taken together with those published by Werneck, are sufficient to indicate the probability that this is not the case. It seems likely that *Trichodectes (Stachiella) ermineae* is confined to *Mustela erminea* and *M. vison*, *T. (S.) kingi* to *M. rixosa*, and *T. (Neotrichodectes) minutus* to *M. frenata* and perhaps *M. nigripes*, but many more records from properly determined hosts will be required before we can be sure whether these suggestions are correct.

Trichodectes (Neotrichodectes) osborni (Kéler, 1944)

Trichodectes mephitidis. Osborn, 1896 (not Packard, 1873), *Bull. U.S. Dep. Agric.* (n.s.) no. 5, p. 242, fig. 150.

Neotrichodectes osborni. Kéler, 1944, *Stettin. ent. Ztg* 105 : 182 (*nomen novum* for above).

From *Spilogale gracilis latifrons* Merriam (Spotted Skunk), University campus, Vancouver, B.C., 16.x.1936, G. P. Holland : 1 ♂, 7 ♀. Same host, locality and collector, 22.x.1936 : 7 ♂, 7 ♀.

The type host of *T. osborni* is *Spilogale interrupta* (Rafinesque), from Tama County, Iowa. Werneck (1948, *Os Malófagos de Mamíferos*, part 1, p. 140) records it from *S. gracilis gracilis* Merriam and *S. ambarvalis* Bangs. It probably occurs on all members of the genus *Spilogale*.

Felicola (Felicola) subrostratus (Burmeister, 1838)

Trichodectes subrostratus. Burmeister, 1838, *Handb. Ent.* 2 : 438.

From House-cat, Vancouver, B.C., 12.xii.1940 and 22.xi.1942, G. J. Spencer : 5 ♂, 28 ♀.
From Cat, Pillsbury, Okanagan Landing, B.C., 4.xi.1941, G. J. Spencer : 1 ♂, 3 ♀.

The domestic cat, *Felis catus* Linn., is the type host of this species and the only one on which it is likely to occur in Canada, though in tropical Africa it is found in great numbers on two not closely related members of the Viverridae. Males are normally scarcer than females but the excess of females in the present collection is greater than usual. It is possible that some males (which are much smaller than females) were passed over as nymphs.

Felicola (Felicola) spenceri sp. nov.

Text-fig. 2 ; Pl. 1, fig. 1

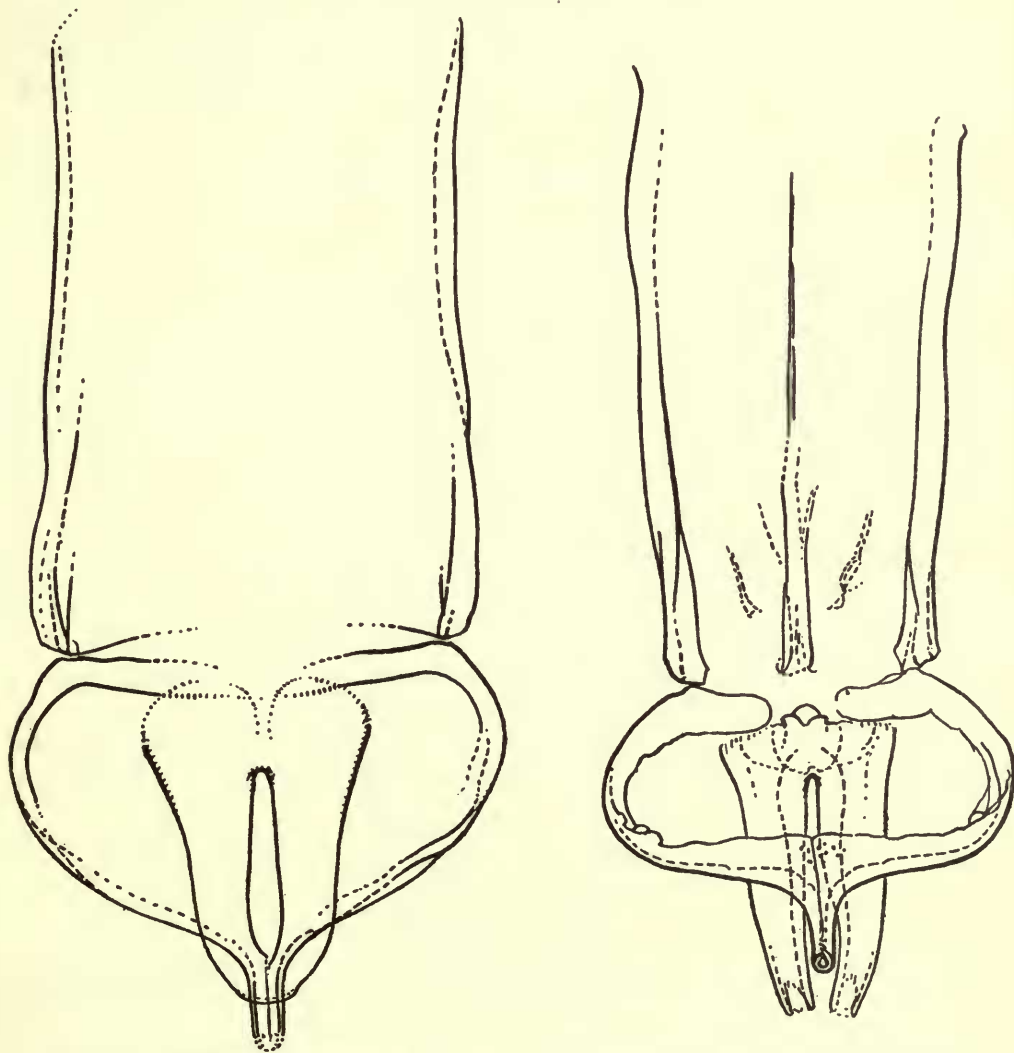
From *Lynx canadensis canadensis* Kerr (Canadian Lynx), Lac La Hache, British Columbia, 1.xi.1954, G. J. Spencer : the ♂ holotype, ♀ allotype and 12 ♂, 11 ♀ paratypes.

From *Lynx canadensis canadensis*, Quesnel or Lac La Hache, 1. xi. 1954, G. J. Spencer: 14 ♂, 10 ♀ paratypes.

From *Lynx canadensis canadensis*, Williams Lake, British Columbia, 15. xii. 1949, H. Jobin: 1 ♂, 2 ♀ paratypes.

Very like *F. (F.) felis* (Werneck), of which it might be considered a subspecies, but the differences in the male genitalia seem to justify specific rank.

Male (Pl. 1, fig. 1). Genitalia as in Text-fig. 2, the basal plate (or basal apodeme) diverging somewhat towards the proximal end (sides subparallel in *felis*, Text-fig. 1) and with a large and well sclerotized median rod at the distal end (the rod absent in



FIGS. 1, 2. Genitalia of males of *Felicola* spp.: 1. *F. felis* (Werneck), from type host and locality. 2. *F. spenceri* sp. nov., holotype.

a paratype of *felis* and in Werneck's figure of the holotype, very small in a specimen from *Felis jaguarundi* Fischer). Spicules of copulatory sac much larger than in *felis*. Endomeres narrower than in *felis*, their sides less divergent and the basal junction between the endomeres of the two sides narrower.

Female. I cannot distinguish *spenceri* from *felis* in this sex.

Werneck (1948, *Malófagos de mamíferos*, part 1, p. 224) had not seen Mallophaga from *Lynx canadensis*; he gives many records of *Felicola felis* from various subspecies of *Lynx rufus* (Schreber) (Bobcat) but though I have not seen specimens from this host I think it improbable that they are *spenceri*, for it is unlikely that so careful a worker as Werneck would not have noticed the differences. The type host of *felis* is an ocelot, *Felis pardalis brasiliensis* (Oken); I suspect that the form from *Felis jaguarundi* may be subspecifically distinct, but refrain from naming it because I have seen only one male. I am much indebted to Dr. Werneck for the loan of paratypes of *F. felis*.

Damalinia (Bovicola) equi (Denny, 1842)

Trichodectes equi. Denny, 1842, *Mon. Anopl. Brit.*: 61, 191.

Trichodectes pilosus. Giebel, 1874, *Insecta epizoa*: 59.

Trichodectes parumpilosus. Piaget, 1880, *Les Pédiculines*: 397, pl. 32, fig. 5.

From horse, Vancouver, B.C., -ii. 1926, G. J. Spencer: 4 ♀.

This is a well-known and cosmopolitan parasite of the horse, *Equus caballus* Linn. The male is excessively rare, though in a very closely related species, occurring on a zebra, males are almost as common as females.

The authorship of the name is commonly ascribed to Linnaeus, but the first description of the species is that of Denny.

Damalinia (Bovicola) bovis (Linn., 1758)

Pediculus bovis. Linnaeus, 1758, *Syst. Nat.* ed. 10: 611.

Trichodectes scalaris. Nitzsch, 1818, *German's Mag. Ent.* 3: 296.

From domestic cattle, Langley Prairie, B.C., 24.iii. 1938, J. G. Jervis: 20 ♀.

From calf, Barnhart Vale, B.C., 16.ii. 1944, G. J. Spencer: 4 ♀.

A cosmopolitan parasite of domestic cattle. Males are extremely uncommon and Mathysse (1944, *J. econ. Ent.* 37: 436-442) has shown that the species is parthenogenetic.

Damalinia (Bovicola) sedecimdecembrii (Eichler, 1946)

Text-fig. 3; Plate 1, fig 2, 3

Bovicola sedecimdecembrii. Eichler, 1946, *Berlin. Munch. tierärztl. Wschr.* 1946: 44, fig.

From *Bison bison* (Linn.) (American Bison), near Hay Camp, Wood Buffalo Park, 22.ii. 1955, W. A. Fuller, sent in by G. P. Holland: 3 ♂, 1 ♀ and 3 nymphs.

Male (Pl. 1, fig. 2). Antenna greatly modified (almost unmodified in *bovis*), the first segment only a little more than $1\frac{1}{2}$ times as long as broad and about as long as

the second and third segments together. Tip of abdomen terminating in a pair of deeply coloured sharp thorn-like projections separated by a deep U-shaped bay. Genitalia (Text-fig. 3) of the same type as in *bovis* but differing greatly in details, the basal apodeme with straighter and more divergent sides, the parameral ring much larger and almost heart-shaped in dorsal view, the endomeres straight, stouter, with blunter free apices, and without a basal flange.

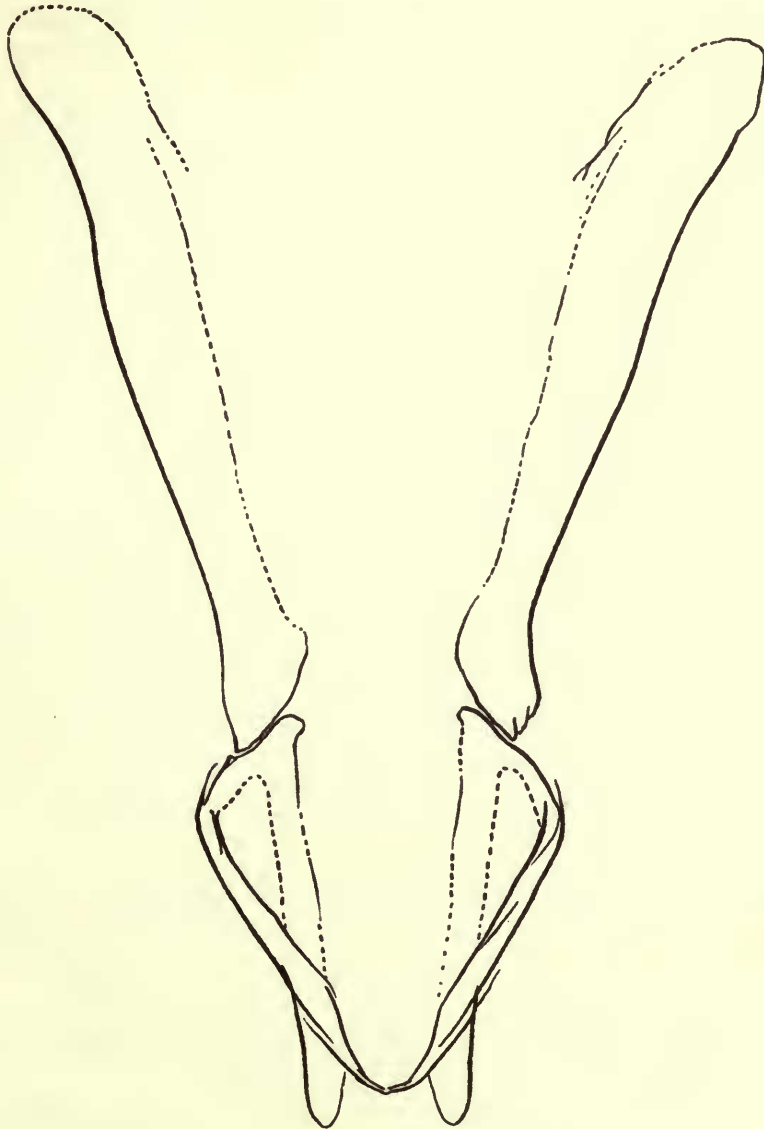


FIG. 3. Genitalia of male *Damalinia sedecimdecembrii* (Eichler), from *Bison bison*, Wood Buffalo Park, Canada.

Female (Pl. 1, fig. 3). The most obvious differences from *bovis* are the shorter head with more truncate anterior margin and narrower sclerotized marginal band, much less strongly coloured abdominal pleurites, and somewhat larger size (length of fully expanded specimen about 2 mm. as against about 1.6 mm. in my largest specimen of *bovis*). Two of the other differences from *bovis* noted by Eichler (stouter antennae and stouter and relatively short legs) are also confirmed by the present specimen, while the shape of the prothorax (stated by Eichler to be broader and straighter-sided than in *bovis*) cannot be made out as the specimen is slightly crushed, but it should be noted that Eichler's figure (1955, *Urania* 17 : 35, fig. 5) was obviously drawn from a not fully expanded specimen.

No member of the Mallophaga has hitherto been recorded from the American Bison, and the determination of these specimens must be considered somewhat doubtful while the male of *sedecimdecembrii* remains unknown from European specimens, but the correspondence between the Canadian female and Eichler's description and figure is so exact as to make it imperative to regard them, at least provisionally, as the same. Eichler's specimens were collected in 1918 from *Bison bonasus* (Linn.) (the European Bison or Wisent) in the Bialowieza forest, Poland, and the date is important because it means that the host was one of the original wild stock which became extinct in 1921 and was subsequently re-established from captive stock. It is not possible to give a subspecific name for the Canadian host because the herds in the Wood Buffalo Park are of mixed descent, an original stock of *Bison bison athabascaae* Rhoads having subsequently received a considerable admixture of the blood of *B. b. bison* (Linn.).

The fact that no Mallophaga have been found previously on the American Bison, although Cameron, for instance (1923, *Vet. J.* 79 : 331-336) records having examined 250 of them for parasites, is not necessarily an indication that they are rare, but merely of the difficulty of obtaining Mallophaga from so large and shaggy a host without using a much more elaborate technique than searching. Eichler suggested in his original description that *sedecimdecembrii* might be parthenogenetic, but if my determination of these specimens is correct this suggestion is improbable. Eichler must have been relying on the analogy of *D. bovis*, since the absence of males from so small a batch as he had is altogether insufficient evidence to support his suggestion, but closely related species may differ entirely in this respect.

Damalinia (Bovicola) ovis (Schrank, 1781)

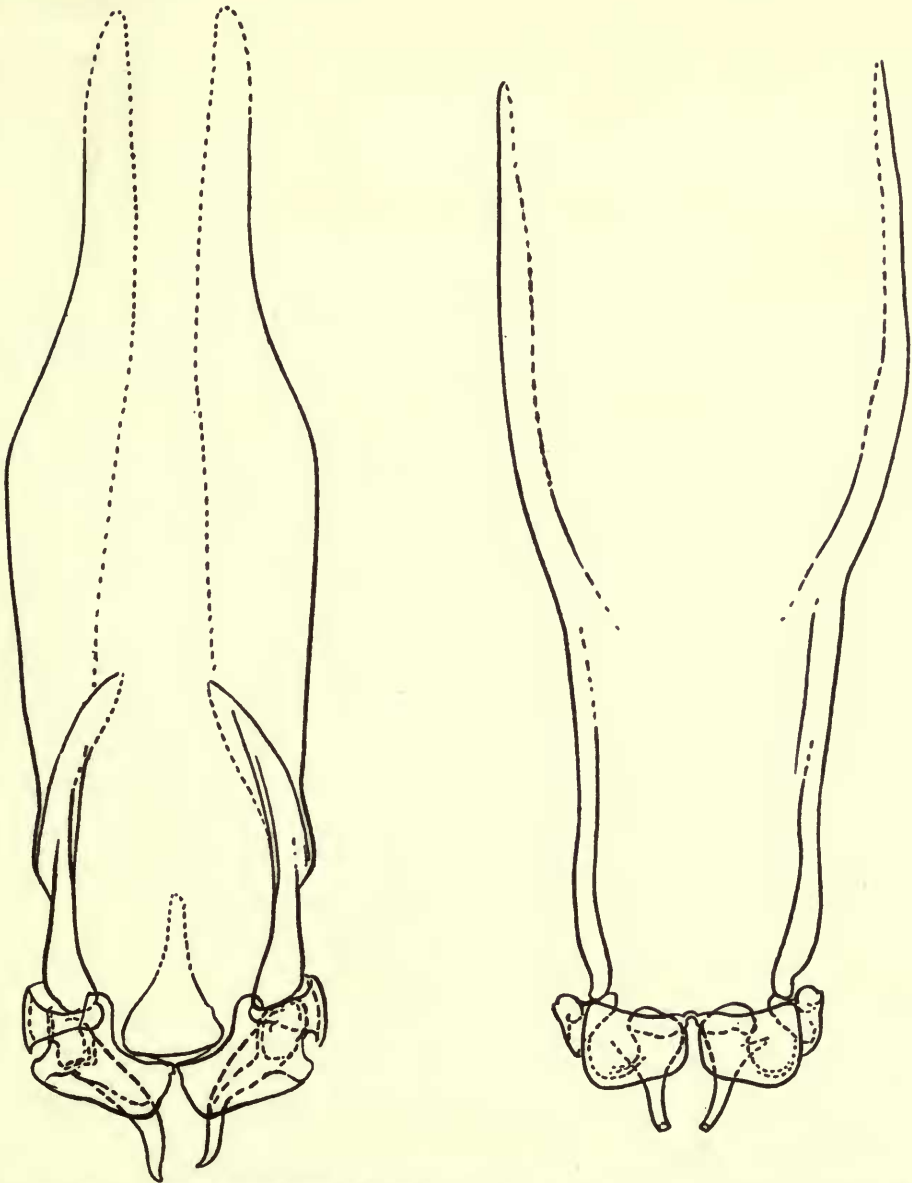
Text-fig. 4 ; Pl. 1, fig. 5

Pediculus ovis. Schrank, 1781, *Enum. Ins. Austr. indig.*, p. 502, pl. 1, figs. 8, 9.

Pediculus sphaerocephalus. Olfers, 1816, *De Veget. . .*, p. 85.

From *Ovis canadensis californianus* Douglas (Northwestern Bighorn Sheep), Churn Creek, British Columbia, 1. vi. 1951, L. Sugden & G. Mitchell : 2 ♀.

A well-known cosmopolitan parasite of the domestic sheep, *Ovis aries* Linn., but not hitherto recorded from the Bighorn. As regards records from other sheep, specimens from *Ovis musimon* Pallas (the Mouflon) were correctly determined but



FIGS. 4, 5. Genitalia of males of *Damalinia* spp.: 4. *D. ovis* (Schrank), neotype.
5. *D. oreamnidis* sp. nov., holotype.

the record requires confirmation because the lice were obtained from captive hosts, while a record from *Ammotragus lervia* (Pallas) (the Barbary Sheep, Arui or Aoudad) refers to misdetermined specimens of a quite different species. This is, therefore, the first undoubted record from a wild sheep.

The rounded setose basal lobe of the gonapophyses forms a smooth curve in both these specimens, whereas in most females from the type host it forms a hump. But some specimens from the type host approach these very closely and more material, including males would be required before one could consider that specimens from the Bighorn are distinct.

***Damalinia (Bovicola) oreamnidis* sp. nov.**

Text-fig. 5 ; Pl. 1, fig. 6

From *Oreamnos americanus missoulae* (Allen) (Montana Mountain Goat), Bryant, Banff National Park, Alberta, 14.vi.1942, I. McT. Cowan : the ♂ holotype and 1 ♂ paratype, 4 nymphs.

The species is close to *D. ovis* and the specimens are not in very good condition, so I have not been able to detect any differences except in the relatively shorter head and in the male genitalia. These latter, however (Text-fig. 5), differ so considerably as to leave no doubt that the difference is specific.

In both the species the genitalia are much specialized and the homology of the distal sclerites very doubtful. The basal plate (or basal apodeme) is much narrower proximally in *ovis* (Text-fig. 4) than in *oreamnidis*, in which it is nearly twice as wide in this portion as in the distal half. The claw-like structures which are probably the endomeres and which project further distally than any of the other sclerites are shorter and more swollen basally in *oreamnidis* and the plate-like structures which I identify with great doubt as the telomeres are much more regularly shaped in this species than in *ovis*.

This appears to be the first record of any Mallophaga from *Oreamnos americanus*.

***Damalinia (Bovicola) longicornis* (Nitzsch, 1818)**

Text-fig. 6

Trichodectes longicornis. Nitzsch, 1818, *Germar's Mag. Ent.* 3 : 296.

Trichodectes similis. Denny, 1842, *Monographia Anoplurorum Britanniae* : 61, 195, pl. 17, fig. 6

Bovicola americanum. Jellison, 1935, *J. Parasit.* 21 : 410, fig. (new synonymy).

From *Cervus canadensis nelsoni* Bailey (Rocky Mountain Wapiti), Jasper Park, Alberta, 20.xii.1944, I. McT. Cowan : 1 ♀.

From *Cervus canadensis nelsoni*, Banff, Alberta, -.ii.1946, I. McT. Cowan : 3 ♀.

The original specimens of *longicornis* and *similis* were from the Red Deer, *Cervus elaphus* Linn., in Europe, while Jellison's material was from the Wapiti, *Cervus canadensis canadensis* Erxleben, from Wyoming. Werneck (1950, *Os Malófagos de Mamíferos*, part 2, p. 79) noted his inability to distinguish specimens obtained from these two hosts but refrained from considering the names to be synonymous because

males are not known in either instance. It is, however, fully in accord with probability that the same lice should occur on *Cervus elaphus* and *C. canadensis*, since the latter is little (if any) more than a giant subspecies of the former.

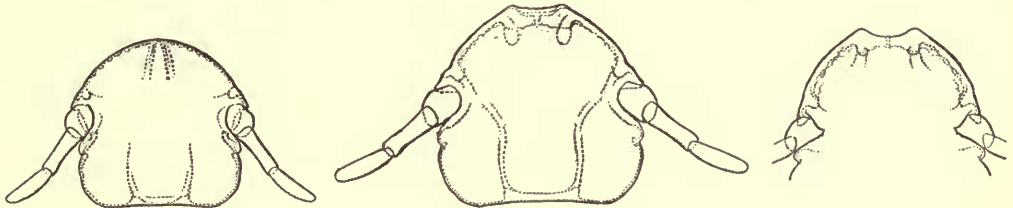
Damalinia (Bovicola) concavifrons sp. nov.

Text-fig. 7, 8

Bovicola "*longicornis* (Nitzsch)". Werneck, 1950, *Os Malófagos de Mamíferos*, part 2: 75 (part; specimens shown in figs. 58 and 59).

Banff, Alberta, from *Cervus canadensis nelsoni* Bailey (Rocky Mountain Wapiti), 3. vi. 1943, I. McT. Cowan: the ♀ holotype and 40 ♀ paratypes.

D. concavifrons apparently differs from *D. longicornis* only in the characters of the preantennal portion of the head, which has relatively thick walls, strongly sloping sides and a short and concave anterior margin in *concavifrons* (Text-fig. 7), whereas in



FIGS. 6-8. Heads (setae omitted) of *Damalinia* spp.: 6. *D. longicornis* (Nitzsch). 7. *D. concavifrons* sp. nov., holotype. 8. *D. concavifrons* sp. nov., paratype.

longicornis (Text-fig. 6) the walls are thinner, the sides are much less sloping and the anterior margin much longer and wholly convex.

D. concavifrons occurs on *Cervus elaphus* as well as on *C. canadensis*, and the specimens figured by Werneck are from the latter host. He considered the difference to be due to polymorphism, and this possibility cannot be wholly excluded. But in other species of *Damalinia*, in which both sexes are known, the shape of the anterior portion of the head is a very constant character and any marked difference in its shape is invariably accompanied by obviously specific differences in the genitalia of the male. In these circumstances it seems safer to regard *longicornis* and *concavifrons* as distinct species. There is some variation in the depth of the concavity of the anterior margin of the head in *concavifrons* (Text-figs. 7, 8) but the shortness of the margin seems constant.

A point of considerable interest is that there appears to be no record, either in Europe or North America, of occurrence of both species on the same individual host. Nitzsch's original series of *longicornis* comprised 12 specimens when it was examined by von Kéler (1938, *Nova Acta Leopoldina* (n.f.) 5: 456) all of which were round-headed, as were all the 3 females in a batch from Germany examined by Werneck (1950, p. 76), but a batch of 14 females from *C. elaphus* in Amsterdam Zoo. comprised

only specimens of *concaivfrons*. Jellison's type-series of *americana* comprised 150 females from four or more animals, and as he does not mention any variation in the shape of the head it must be assumed that all were round-headed. Of the three Wapiti from which there are Mallophaga in the Spencer collection, two were infested only with *longicornis* and the third only with *concaivfrons*. These facts are almost perfectly paralleled in the case of the two species of Trichodectidae found on members of the genus *Odocoileus* in North America, which is an additional reason for regarding *longicornis* and *concaivfrons* as distinct species.

It seems certain that both *longicornis* and *concaivfrons* must be parthenogenetic, though it is probable that males occur very rarely, as in other parthenogenetic species of the genus (*D. bovis* and *D. equi*).

Damalinia (Tricholipeurus) lipeuroides (Méglin, 1884)

Trichodectes lipeuroides. Méglin, 1884, *Naturaliste* no. 62 : 494, figs.

Eutrichophilus mexicanus. Mjöberg, 1910 (not Rudow, 1866), *Ark. Zool.* 6, part 13 : 79, figs. 49, 50, pl. 4, figs. 1, 2.

Eutrichophilus mazama. Stobbe, 1913, *Dtsch. ent. Z.* 1913 : 562 (*nomen novum* for *mexicanus* Mjöberg).

Tricholipeurus virginianus. Peters, 1930, *Proc. ent. Soc. Wash.* 32 : 76, figs. 1-3.

From *Odocoileus hemionus hemionus* (Rafinesque) (Rocky Mountain Mule-Deer), Quick, British Columbia, 16.i.1944, H. Wearne : 27 ♂, 15 ♀.

From *Odocoileus hemionus hemionus*, Quick, -.xi.1945 : 4 ♂.

From *Odocoileus hemionus hemionus*, Quick, 23.ii.1948 : 55 ♂, 10 ♀.

From *Canis latrans incolatus* Hall (N. W. Coyote), Quick, 12.x.1940, H. Wearne : 5 ♂, 8 ♀.

From *Odocoileus hemionus hemionus*, Vavenby, B.C., 1934, on piece of hide received from T. K. Moilliet : 1 ♀.

From *Odocoileus hemionus hemionus*, Vavenby, spring 1937, T. K. Moilliet : 1 ♀.

From *Odocoileus hemionus hemionus*, near Revelstoke, B.C., 22.v.1932, G. J. Spencer : 2 ♀.

From *Odocoileus hemionus hemionus*, Banff, Alberta, 28.iv.1943 : 2 ♀.

From a sick *Odocoileus hemionus columbianus* (Richardson) (Columbian Black-tailed Deer or Coast Deer), Hardy Is., B.C., 3.iv.1943, G. J. Spencer : 9 ♂, 9 ♀.

From *Odocoileus hemionus columbianus*, Comox, Vancouver Is., B.C., 9.xi.1930, G. J. Spencer : 1 ♂.

From *Odocoileus hemionus columbianus*, Mt. Lehman, near Abbotsford, B.C., 22.v.1910, S. Hadwen : 8 ♂, 1 ♀.

From *Odocoileus hemionus columbianus*, Barnet, near Vancouver, B.C., 5.iv.1943, G. J. Spencer : 7 ♂, 10 ♀.

From *Odocoileus hemionus columbianus*, Cowichan Lake, British Columbia, 18.xii.1947 : 9 ♂, 1 ♀.

From *Odocoileus hemionus columbianus*, Victoria, B.C., 10.xi.1938, I. McT. Cowan : 10 ♂, 2 ♀.

From *Odocoileus hemionus columbianus*, Vancouver, B.C., 19.xi.1933, G. J. Spencer : 11 ♀.

From *Odocoileus hemionus columbianus*, Howe Sound, B.C., 7.xii.1929, G. J. Spencer : 1 ♂, 1 ♀.

From *Odocoileus hemionus columbianus*, Salt Spring Is., B.C., 2.ii.1941, I. McT. Cowan : 10 ♀.

The type host of this species, and that of the material on which the names given by Mjöberg and by Stobbe were based, is *Odocoileus virginianus mexicanus* (Gmelin) (Mexican White-tailed Deer), while Peter's material was from *O. v. virginianus* (Zimmerman) and *O. v. texanus* (Mearns), and there are records from a number of other subspecies of *O. virginianus*. The species has, however, been recorded many times from various subspecies of *Odocoileus hemionus* and there is no doubt that it is a normal parasite of both species of deer. The coyote had presumably picked up its infestation by feeding on a dead deer, and it is most unlikely that the infestation would have persisted, but the record fits in well with the instance recorded by Paine (1912, *Ent. News* 23 : 438) of the occurrence of 4 specimens of *Damalinia (Damalinia) forficula* (Piaget), another deer-parasite, on *Cuon alpinus* (Pallas) (Dhole, or Red Dog), each record tending to confirm the other.

The considerable preponderance of males in the Spencer collection (136 ♂, 84 ♀) is probably misleading and perhaps due to unintentional selection, since Crauford-Benson (1941, *Parasitology* 33 : 346-350) and Hopkins (1949, *Proc. zool. Soc. Lond.* 119 : 407) have both demonstrated the very great variability in sex-proportions in collections made from different portions of the host's body. Peters' material included 75 ♂ and 69 ♀ and that of Werneck 22 ♂, 29 ♀ (97 ♂ 98 ♀, for the two sets of records together).

Damalinia (Tricholipeurus) parallela (Osborn, 1896)

Trichodectes "tibialis Piaget." Osborn, 1896 (not Piaget, 1880), *Bull. U.S. Dep. Agric.* (n.s.) no. 5 : 240, figs. 147a, b.

Trichodectes parallelus. Osborn, 1896, *op. cit.*: 240, fig. 148.

Trichodectes odocoilei. McGregor, 1917, *Ann. ent. Soc. Amer.* 10 : 173, pl. 17, fig. 7.

From *Odocoileus hemionus hemionus* (Rafinesque) (Rocky Mountain Mule-Deer), near Revelstoke, B.C., 22.v.1932, G. J. Spencer : 5 ♀.

From *Odocoileus hemionus hemionus*, Quesnel, B.C., 18.v.1932, G. J. Spencer : 13 ♂, 1 ♀.

From *Odocoileus hemionus hemionus*, Quesnel, 19.v.1932, G. J. Spencer : 19 ♂, 7 ♀.*

From *Odocoileus hemionus hemionus*, Vavenby, B. C., spring 1937, T. K. Moilliet : 3 ♂.

From *Odocoileus hemionus columbianus* (Richardson) (Columbian Black-tailed Deer or Coast Deer), Duncan, B.C., 10.v.1942, G. J. Spencer : 2 ♂, 14 ♀.

The question of the correct name of this species is one of considerable difficulty. Osborn (1896, p. 240, fig. 147) misdetermined as *Trichodectes tibialis* Piaget "some specimens from the black-tailed deer (Baker collection)" which undoubtedly belong to the species later described by McGregor as *T. odocoilei*. Osborn also described as *T. parallelus* "three specimens (females) from deer, collection Cornell University, kindly loaned by Prof. J. H. Comstock . . . Species of deer is not given, but probably Virginia deer (*Cariacus virginianus*) is meant"; Osborn's figure depicts a female or nymph. Peters, 1939 (in Spencer, *Proc. ent. Soc. B. C.* no. 35 : 18) placed *odocoilei* as a synonym of *parallelus*, but this synonymy was rejected by Werneck (1950, *Os Malófagos de Mamíferos*, part 2 : 184) on the grounds that the syntypes were nymphs, which are not determinable in this group; the reason for Peters'

* Many specimens must have been removed from this tube, for the label refers to 42 ♂, 46 ♀.

belief is evidently (Peters, *in litt.*, II. xi. 1937, and see Werneck, 1950, p. 184) that he not unnaturally regarded as syntypes the specimens on a slide received from Professor Osborn and marked " Type ", but which contained " a number of specimens, among which were several males ", and which therefore cannot possibly belong to the original type-series ; it is very possible that they were some of the specimens which Osborn had misdetermined as *tibialis*. Even though these specimens must be ignored in considering the identity of *Trichodectes parallelus*, I still accepted the synonymy suggested by Peters (though with grave misgivings because of the inadequacy of Osborn's figure and Werneck's belief, which I shared, that the syntypes were nymphs) because Osborn's figure is much more like *odocoilei* than *lipeuroides*. But Col. Emerson kindly tells me that he has examined Osborn's syntypes of *Trichodectes parallelus*, that they are females with developed gonapophyses (though probably teneral) and that he has no doubt that they are the species subsequently described as *odocoilei*.

The type host of *D. parallela* (Osborn) was merely " deer ", but Col. Emerson tells me that the slide bears the information, omitted by Osborn, that the specimens were collected at Ithaca, N.Y., on 12th Aug. '86, by L. Pearson, and that the host must, therefore, have been *Odocoileus virginianus* ssp. The type host of *D. odocoilei* is *Odocoileus virginianus macrourus* (Rafinesque) (Plains or Western White-tailed Deer) and there are many records from various subspecies of *O. virginianus* and *O. hemionus*. Occurrence of both this species and *lipeuroides* on the same host-individual is apparently rare, while a heavy infestation with one of them seems to preclude a heavy infestation with the other. In the present collection there are two apparent instances of a double infestation of one host-individual : the batch of specimens collected from *O. h. hemionus* at Vavenby in spring 1937 contains 3 male *parallela* and 1 female *lipeuroides*, while there are 5 females of *parallela* and 2 of *lipeuroides* in the batch obtained from the same subspecies of host near Revelstoke on 22.v.1932. The parallel with the occurrence of *D. (Bovicola) longicornis* and *D. (B.) concavifrons* on members of the genus *Cervus* is obvious.

Males and females of this species apparently occur in roughly equal numbers. Werneck (1950 : 180) examined 10 ♂, 13 ♀ and the present collection contains 37♂, 27 ♀ (60 ♂, 66 ♀ if the second tube from Quesnel is credited with the numbers it is stated to have contained originally). The great excess of males in the first tube from Quesnel is, therefore, presumably accidental and probably results from unintentional selection.

Damalinia (Tricholipeurus) sp.

From captive male *Odocoileus hemionus columbianus* (Richardson) (Columbian Black-tailed Deer), Vancouver, British Columbia, died 8.ii.1954 : many ♀.

These specimens are certainly not any of the known species from North American deer, the concavity of the frons being far more marked than in any of these ; in this respect they are not unlike *D. (Tricholipeurus) dorcelaphi* (Werneck), but differ markedly in the shape of the gonapophyses. It is very possible that they belong to a new species, but in view of the fact that the host was a captive I think it would be wrong to describe them, especially in the absence of males. The infestation was

certainly established, for the batch contained many eggs and nymphs, but it may well have been acquired from a fellow-captive belonging to some other species. The parasite is not present in any of the collections from wild hosts.

Eutrichophilus setosus (Giebel, 1861)

Trichodectes setosus. Giebel, 1861, *Z. ges. Natwiss.* 18 : 86.

From *Erethizon dorsatum nigrescens* Allen (eastern Canada Porcupine), Jasper National Park, Alberta, 12.vi.1930, I. McT. Cowan, G. J. Spencer : 1 ♀.

From *Erethizon dorsatum nigrescens*, Jasper Park, 11.vi.1944, J. Hatter : 5 ♂, 8 ♀.

From *Erethizon dorsatum nigrescens*, Quesnel, B.C., 14.v.1932, J. McT. Gowan, G. J. Spencer : 15 ♂, 27 ♀.

From *Erethizon dorsatum nigrescens*, Kamloops, B.C., 21.vii.1934, G. J. Spencer : 33 ♂, 11 ♀.

From *Erethizon dorsatum nigrescens*, Williams Lake, B.C., 27.iii.1934, G. J. Spencer : 14 ♂, 32 ♀.

Erethizon dorsatum (Linn.) is the type host of this species and probably the only one on which it occurs in nature.

***Geomydoecus* sp.**

A single nymph from *Thomomys talpoides* ssp., Carlyle Lake, Sask., 26.vii.1942, G. P. Holland.

There is some probability that this specimen is *G. thomomyus* (McGregor), which is known from *Thomomys talpoides fuscus* and *T. talpoides douglasi* in the U.S.A., but nymphs are not determinable in the genus *Geomydoecus*.

MATERIAL FROM OTHER AREAS

Felicola (Felicola) rohani Werneck, 1956

Felicola rohani. Werneck, 1956, *Rev. brasil Biol.* 16 : 25, figs. 1-5.

From *Herpestes auropunctatus siamensis* (Kloss), Khorat City, Thailand, 12.ii.1953, R. E. Elbel : 14 ♂, 13 ♀.

From *Herpestes auropunctatus siamensis*, Boekphrai, Banpang, Rat Buri, Thailand, 10.v.1952, Banpang Plague Lab.: 1 ♂, 1 ♀.

From *Herpestes auropunctatus siamensis*, Banpang, Rat Buri, Thailand, 29.iv.1952, R.E. Elbel : 2 ♂.

From *Herpestes auropunctatus siamensis*, Chaiyaphum, Phukhio, Non Khun, Thailand, 11.xii.1952, R. E. Elbel : 5 ♂, 3 ♀.

The host-record is a new one, since Werneck's material was obtained in Mauritius from the introduced *Herpestes edwardsi edwardsi* (Geoffroy), but I can find no significant difference between the present specimens and those described by Werneck and depicted in his excellent figures. There is, however, one interesting difference between these specimens and the type lot : Werneck's fig. 4, apparently drawn from an unmounted specimen, shows the tips of the endomeres inclining outwards, while in his fig. 5 the apical portion of the endomeres is twisted and the tips point inwards ; he regards the latter condition as an abnormality, though noting that it is frequent (there were 4 males in the type series). But in the present series the endomeres are

twisted in such a way that their tips incline inwards in 20 of the 21 specimens, while in the remaining male they are badly damaged and I cannot tell their true shape. It seems, therefore, that the twisted condition of the endomeres is the normal one.

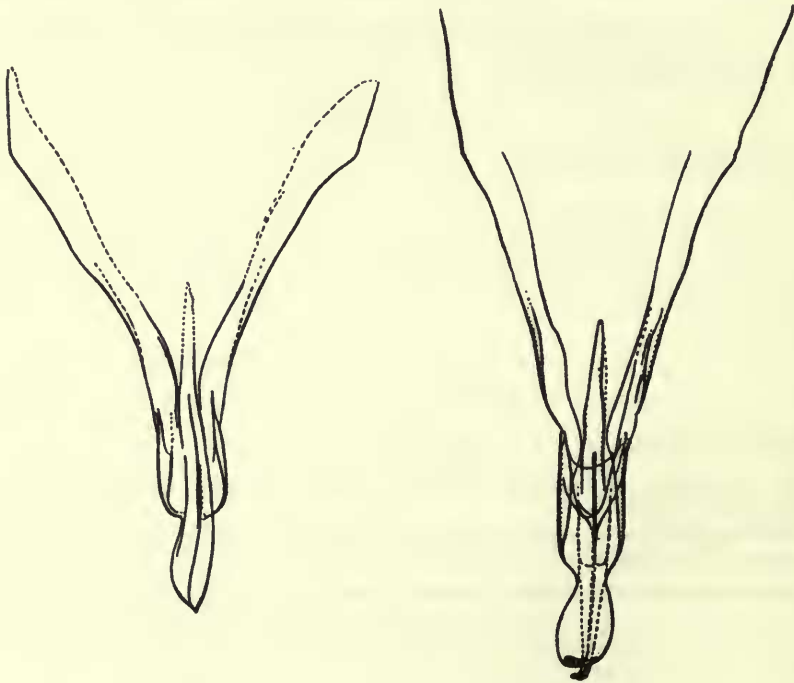
Felicola (Protelicola) intermedius hyaenae ssp. nov.

Text-fig. 10 ; Pl. 2, figs. 3, 4

From *Hyaena brunnea* Thunberg (Brown Hyena), Palapye, Bechuanaland, 26.v.1957, G. Theiler : the ♂ holotype.

From *Hyaena brunnea*: Kukong, southern Bechuanaland, about half-way between Kanye and Tsane (between 24° and 25° S. and about 23° E.), 29.xi.1957, received from Dr. F. Zumpt : the ♀ allotype, 1 ♂ paratype and 1 nymph.

Very like *F. i. intermedius* (Bedford, 1932) (*Parasitology* 24 : 355, figs. 1c, 2) but averaging larger, the preantennal portion of the head with more convex margins



FIGS. 9, 10. Genitalia of male *Felicola intermedius* spp.: 9. *F. i. intermedius* (Bedford), male from type-series. 10 *F. i. hyaenae* ssp. nov., holotype.

(contrast Pl. 2, figs. 1 and 3, 2 and 4) and with slight differences in the male genitalia (Text-fig. 10, contrast Text-fig. 9). A very striking difference in the male genitalia is the much greater divergence of the sides of the basal apodeme in the nominate subspecies (Text-fig. 9) but as I have seen only one male of this form there is some possibility that the difference is due to the accidents of mounting.

I am much indebted to Dr. Zumpt for the opportunity to see this material and to Mr. R. du Toit, Veterinary Research Laboratories, Onderstepoort for the loan of that portion of the type-series of *F. intermedius* Bedford (one male, two females and a nymph) which is in the Onderstepoort collection. I have also examined two South African females, from the same host-species, in my own collection.

This is the first record of any member of the Phthiraptera from a hyaena and is of special interest because it has been suggested (Hopkins, 1949, *Proc. zool. Soc. Lond.* 119 : 506) that hyaenas might be louse-free ; the apparent anomaly of absence of lice on a major taxon of the Fissipeda (or land-Carnivora) is now shown to be illusory. The host of *Felicola i. intermedius* is *Proteles cristatus*, the sole member of the other extant subfamily of the Hyaenidae.

Trichodectes (Trichodectes) emersoni sp. nov.

Text-figs. 11-13 ; Pl. 1, fig. 4 ; Pl. 2, figs. 5, 6

From *Helictis orientalis everetti* Thomas, Kamborangah, Mt. Kinabalu, North Borneo, 7.vi.1952, Anglo-Amer. Med. Res. Unit : the ♂ holotype, ♀ allotype and 3 ♀ paratypes.

From *Helictis orientalis everetti*, Tenompak, Mt. Kinabalu, North Borneo, 8.vii.1951, Anglo-Amer. Med. Res. Unit : 3 ♂, 6 ♀ paratypes, 1 nymph.

From *Helictis orientalis everetti*, Tenompak, Mt. Kinabalu, North Borneo, 20.viii.1953, Anglo-Amer. Med. Res. Unit : 12 ♂, 25 ♀ paratypes, 3 nymphs.

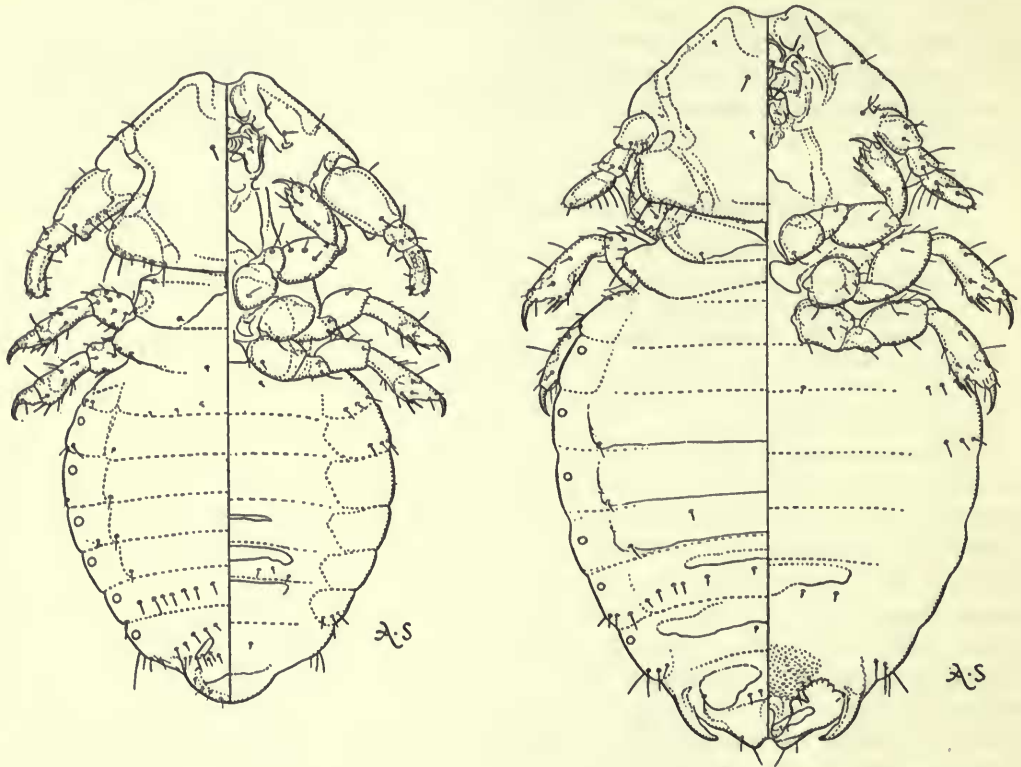
The taxonomy of the Trichodectidae at the generic and subgeneric level constitutes one of the more difficult problems in the systematics of the Mallophaga, and the present species adds to the difficulty. Within the mass of species found on Fissipeda there are various groups, of which *Felicola* Ewing 1929 is (as exemplified by its type species and the nearest relatives of the latter) one of the most distinct from the more characteristic species of *Trichodectes* Nitzsch, 1818. Unfortunately, however, there are so many species which show deviations from the characteristics of the more typical members of both groups that, in his comprehensive and excellent revision of the Trichodectidae, Werneck (1948, *Os Malófagos de Mamíferos*, part 1) has been forced to utilize the generic name *Suricatoecus* Bedford, 1932 (incapable of exact definition) for a miscellany of species which link *Trichodectes* s.str. with *Felicola* s.str. and which cannot be confidently referred to either group, even after allowing generously for deviations like the presence of six pairs of abdominal spiracles in *F. caffer* (Bedford) (a species which is very closely related to others in which the number of pairs of abdominal spiracles is either three or none).

Trichodectes emersoni fits fairly well into *Trichodectes* s.str., but the reduced chaetotaxy, presence of sclerotized tergal plates, and the moderately salient tip of the abdomen in the male are suggestive of *Felicola* and it might very well have been included in *Suricatoecus*. The sclerotic bands of the abdomen are particularly reminiscent of *S. decipiens* (Hopkins), from which *emersoni* differs greatly in other respects.

Head slightly wider than long in both sexes (index 0.76 in holotype, 0.80 in allotype) its anterior margin with a wide but not very deep osculum, sides of pre-antennal portion of head almost straight. Antenna very large in male, the first segment subequal in length to the other two together, much smaller in the female and segment

I shorter than III. Bristles of dorsum of head very few and small apart from a row of six, along the hind margin, which includes a few slightly larger ones.

Abdomen oval, broadest at fourth (apparent third) segment, slightly longer than wide (index 1.14 in holotype, 1.07 in allotype), with 6 pairs of spiracles. Bristles few and very small, placed as shown in Text-figs. 11 and 12. Weakly sclerotized



FIGS. 11, 12. *Trichodectes emersoni* sp. nov.: 11. Holotype. 12. Allotype.

plates present on the dorsum of the penultimate segment in both sexes (this plate widely interrupted in the middle), on the venter of segments 5-7 in the male and on the dorsum of segments 7-9 and venter of segment 7 in the female. Male with last segment of abdomen forming an almost semicircular rounded prominence. Male genitalia as in Text-fig. 13, the basal apodeme tapering cephalad and probably ending in a point, parameres not forming a ring but giving the impression that they are probably joined in the middle line by an unsclerotized portion, endomeres with very sharp tips, spicules of copulatory sac coarse, those near the middle line (when the sac is retracted) about twice as large as the rest.

Length of holotype 1.08 mm., of allotype 1.26 mm. Holotype male and allotype female in the United States National Museum.

T. emersoni (which I have named in honour of Col. K. C. Emerson, from whom I received the material) is the first species of Mallophaga to be recorded reliably from *Helictis*, though Neumann (1913, *Arch. Parasit.*, Paris 15 : 618) purported to recog-

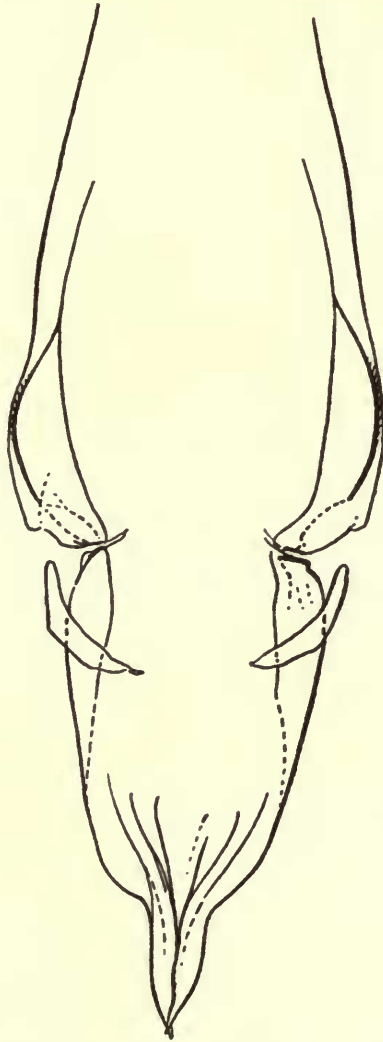


FIG. 13. Genitalia of male holotype of *Trichodectes emersoni* sp. nov.

nize as *Trichodectes* (*Neotrichodectes*) *mephitidis* Osborn " un jeune individu recueilli sur *Helictis Emeretti* au Muséum d'Histoire naturelle de Paris ", which may perhaps have been a nymph of *emersoni*. In spite of important differences, *T. emersoni* is perhaps nearest related to *T. melis* (O. Fabricius) and *T. vosseleri* Stöbbe, which also parasitize members of the Melinae.